Heart Rate Response after Heart Transplantation

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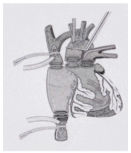
INTRODUCTION

Denervation at heart transplant (HTx) results in attenuated heart rate (HR) control and limited exercise tolerance.

PURPOSE

The aim of this study was to assess longitudinal changes in the HR response to exercise in HTx recpients. We compared the results with those of healthy controls.



METHODS

The HR response to maximal cardiopulmonary exercise was tested in 50 *de novo* HTx recipients at 11 weeks (range 7-16) after surgery, at 1-year follow-up and in 50 age and gender matched controls. The HR was measured at rest, at 25-, 50-, 75-, and 100% of VO_{2peak}, and 30 sec, 1, 2, 3 and 4 min after peak exercise on a treadmill or bicycle ergometer. We also assessed the HR reserve and the chronotropic response index.

RESULTS

11 weeks after HTx, the HR response to exercise was blunted, but improved significantly during follow-up. The change in HR from rest to peak exercise increased by 48% (46 bpm vs 68 bpm; p<0.001) from inclusion to the 12 months' follow-up (Figure). In comparison, the change in HR during exercise in controls was 115 bpm. In HTx recipients, approximately 50% of the total increase in HR occurred between rest and 25% of VO_{2peak} (figure). In the controls, roughly 40% of the total increase in HR occurred during the initial 25% of VO_{2peak}. The HTx recipients had a significantly higher change in HR between 75- and 100% of VO_{2peak} at inclusion than at 1-year follow-up (p=0.004) and this delayed change in HR was higher than in controls (p = 0.001). The chronotropic response index increased during follow-up (0.48 ± 0.2 vs 0.79 ± 0.2; p< 0.001) and normalized in 50% of the HTx recipients at 1 year. Finally, the HR declined more rapidly after exercise at follow-up than at inclusion, however, the decline remained slower than in controls (Figure).

Table 1. Cardiopulmonary Exercise Test

	Baseline	12 months	p-value for change	Healthy controls
HR rest (beats/min)	**85 (10,8**	**86 (10,2)**	**0.39**	**61 (8,3)**
HR 25% VO2 (beats/min)	105 (12,2)	117 (12,1)	*<0.001*	107 (15,0)
HR 50% VO2 (beats/min)	111 (13,9)	127 (15,8)	*<0.001*	132 (15,1)
HR 75% VO2 (beats/min)	117 (16,3)	139 (18,9)	*<0.001*	157 (16,3(IR)
HR max (beats/min)	128 (18,9)	151 (20,7)	*<0.001*	178 (16,1(IR)
HR max, % of predicted	73,1 (12,4)	88,6 (12,6)	*<0.001*	103,4 (6,5(IR)
HR reserve (beats/min)	41 (17,9)	65 (19,3)	*<0.001*	122 (17,3)
CRI	0,48 (0,21)	0,79 (0,24)	*<0.001*	1,05 (0,01)
RER	1,19 (0,1)	1,2 (0,1)	0.71	1,26 (0,09)
VO2 peak (mL/kg/min)	21,1(5,0)	24,7 (6,7)	*<0.001*	40,3 (7,9)
VO2 peak , % of predicted	56,5 (13,0)	67,2 (16,3)	*<0.001*	107,3 (16,2)
SBP rest (mm Hg)	121 (12,9)	118 (16,3)	*0.01*	109 (13,6)
DPB rest (mm Hg)	79 (30,2)	79 (16,3)	*<0.001*	72 (72 (10,3)
SPB max (mm Hg)	187 (30,2)	212 (32,1)	*0.02*	204 (26,2)
DPB max (mm Hg)	83 (17,1)	86 (18,1)	0.90	85 (18,1)

Data are expressed as mean (SD/IQR) or %. P values compare heart transplant recipients at baseline and 12 months follow-up. HR, heart rate; VO2, peak oxygen uptake; CRI, chronotropic response index; RER, respiratory exchange ratio.

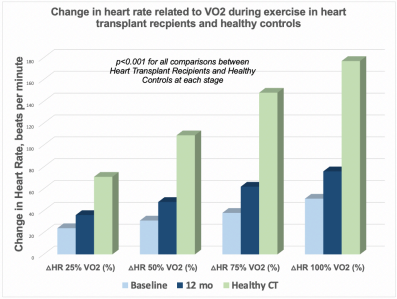
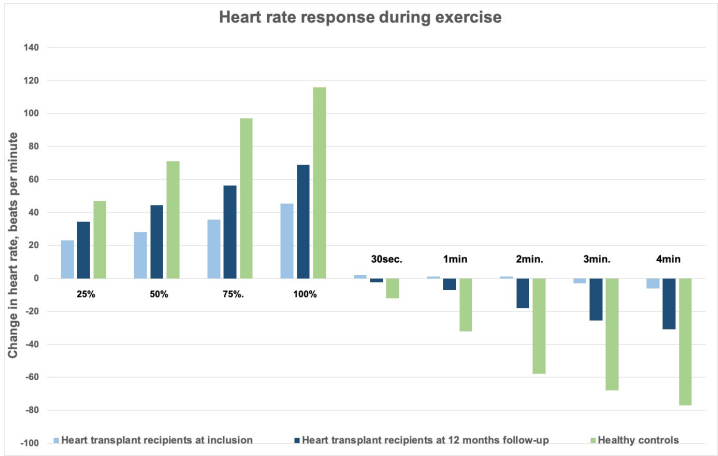


Fig. Percentage change in heart rate at each step above rest

	Baseline	12 mo	Healthy CT
ΔHR 25% VO2 (%)	24	36	71
ΔHR 50% VO2 (%)	31	48	109
ΔHR 75% VO2 (%)	38	62	148
ΔHR 100% VO2 (%)	51	76	177



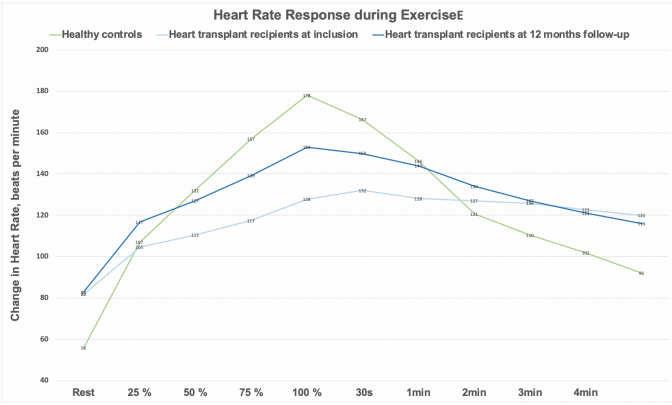
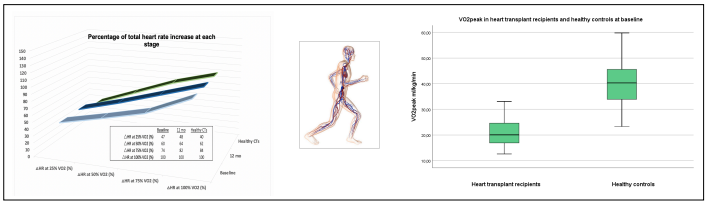


Fig. Heart rate response during and after exercise

CONCLUSION

The increase and decrease in heart rate during exercise are considerably reduced in *de novo* HTx recipients, but improve during the first year after surgery. Whether this response continues to improve during longer follow-up remains to be determined



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